


eComment: The sound of silence: the harmonic analysis in thoracic surgery

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We have read with interest the paper by Nowak et al. about microwave reflectometry as a tool to observe edema formation of the lung during thoracic surgery [1]. The authors describe that the dielectric properties of the lung tissue were measured based on the analysis of microwave noise codes and reflection coefficient of the open-ended coaxial line probe obtained from the noise codes by Fourier transform.

In mathematics, the Fourier transform is the operation that decomposes a signal into its constituent frequencies. For example, the Fourier transform of a musical chord is a mathematical representation of the amplitudes of the individual notes that make it up. The original signal depends on time (time-domain representation of signal), whereas the Fourier transform depends on frequency (frequency-domain representation of signal) [2].

As reported by Nowak et al. [1] in the discussion section, shorter data acquisition times and smaller voltage stress for lung tissue with similar spectral power would make it much easier to keep the probe in constant contact to the lung tissue during the data acquisition period. However, to reduce the time of data acquisition bias, we suggest using, instead of the traditional harmonic analysis, the De Groot Fourier transform, a simple method which introduces variable time and frequency resolution in spectrogram analysis. The short-time Fourier transform uses the harmonics, but it has a fixed time and frequency resolution depending on the chosen window size. When the window size is decreased, time resolution increases, but frequency resolution decreases.

In conclusion, the De Groot Fourier transform brings variable time and frequency resolutions to the Fourier analysis and it could be useful for specific applications, such as the interesting microwave analysis of intraoperative lung edema.

References

